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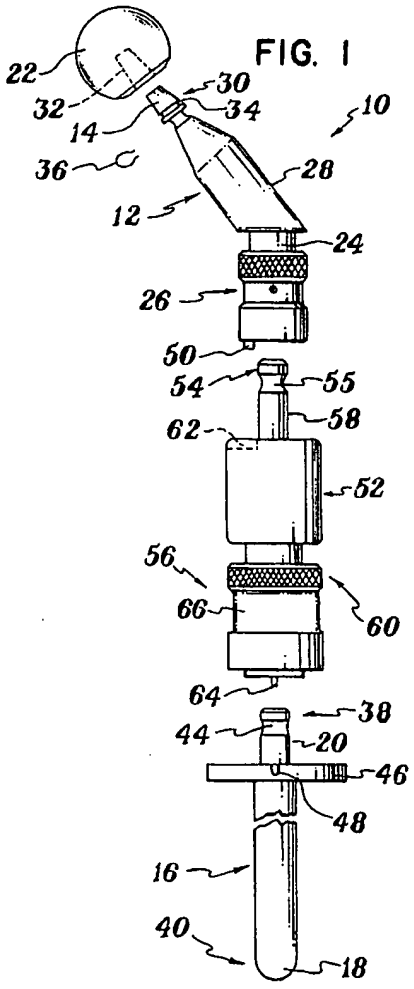
(54) Modular trial instrument with interlock mechanism.

(57) According to the present invention, a modular trial instrument (10) having opposed ends for sizing of an implantable orthopedic prosthesis is provided. The instrument (10) comprises a head component (12) located at one end of the trial and having at least one connection portion (14) and a stem component (16) located at the other end of the trial defining a longitudinal axis. The stem component (16) includes a tip portion (18) and a connection portion (20) longitudinally opposed from the tip portion (18). The tip portion (18) of stem component (16) is received in the medullary canal of a bone. It will be apparent to those skilled in the art that the trial instrument (10) can be used for sizing an implantable orthopedic prosthesis for any limb, for example, a humerus or a femur.

FIG. 1



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The present invention relates to a trial for sizing replacement prosthesis for a portion of a bone. More particularly, the present invention relates to a modular trial for determining the size of a replacement prosthesis for a limb of the body.

Various prostheses have been designed to replace a portion of a bone joint. Generally, a head portion is connected to an arm composed of a neck and a stem or shaft that will be embedded in the medullary canal of a bone for reconstruction. Such prostheses are often formed with an integral stem and neck portion, often a removable head element is positioned on the proximal end of the neck.

Recently modular structures fitted together from a number of replaceable parts that are available in a variety of sizes have been used. Using such prostheses, it is possible to replace either the head portion or trochanteral portion of the prostheses or both portions without removing the stem from the bone cavity. U.S. Patent Nos. 4,676,797 and 4,693,724 are illustrative of such devices.

A disadvantage of the prostheses mentioned above is they limit the surgeon's ability to simply and quickly assemble the proper prothesis components during surgery and require using the actual prosthesis components for sizing, thus risking sterility of the prosthesis components.

According to the present invention, a modular trial instrument having opposed ends for sizing of an implantable orthopedic prosthesis is provided. The instrument comprises a head component located at one end of the trial and having at least one connection portion and a stem component located at the other end of the trial defining a longitudinal axis. The stem component includes a tip portion and a connection portion longitudinally opposed from the tip portion. The tip portion of stem component is received in the medullary canal of a bone.

One advantage of the present invention is the trial preferably consists of components of various lengths and sizes that are adapted to be assembled together to form a custom trial for a prosthesis of a desired length and size. One advantage of this feature is that a trial of a desired length and size may be assembled and adapted to fit the needs of the patient during the operation.

Another advantage of the present invention is the trial can be quickly and easily assembled and disassembled without the expenditure of special forces and the use of any tools.

Another advantage of the present invention is a modular trial is provided that allows a surgeon a great deal of flexibility as to the length and size of the trial.

Another advantage of the present invention is a surgeon may easily assemble a custom trial in the operating room before the prosthesis is inserted into the patient.

Yet another advantage of the present invention is a modular trial is provided such that individual components can be assembled and disassembled, the prosthesis need not be rotated in screwing movements or the like, allowing the trial to be easily used in confined areas.

The modular trial of the present invention thus provides the ability to assemble and disassemble a number of components to produce a custom trial prosthesis by selecting different lengths and sizes of individual components to meet the requirements of the individual patient exactly.

The invention may be better appreciated by reference to the attached drawings, which illustrate one or more preferred embodiments, wherein:

FIG. 1 is an exploded perspective view of the modular trial instrument of this invention,

FIG. 2 is a side view of the head component including the quick-disconnect,

FIG. 3 is an end view showing quick-disconnect of the head component,

FIG. 4 is a side view of the intermediate component including the the quick-disconnect with parts broken away,

FIG. 5 is an end view of the distal end of the intermediate component and the quick-disconnect, and

FIG. 6 shows a cross sectional view of the quick-disconnect in conjunction with connection portion of a stem component inserted in the medullary canal of a bone.

Referring to **FIG. 1**, a modular trial instrument having opposed ends for sizing of an implantable orthopedic prosthesis is generally shown at **10**. The trial instrument comprises a head component **12** located at one end of the trial and having at least one connection portion **14**. A stem component **16** is located at the other end of the trial defining a longitudinal axis. Stem component **16** includes tip portion **18** and connection portion **20** longitudinally opposed from the tip portion. The tip portion of stem component 16 is received in the medullary canal of a bone. It will be apparent to those skilled in the art that the trial instrument can be used for sizing an implantable orthopedic prosthesis for any limb, for example, a humerus or a femur.

Referring to **FIGS. 1** and **2**, a preferred embodiment of the modular trial instrument for orthopedic implantation of a hip prosthesis is generally shown at **10**. The instrument comprises head component **12**, stem component **16** and a ball indicated at **22**. Head component **12** includes shaft **24** having one end attached to a releasable interlock mechanism, such as quick-disconnect **26** and the other end attached to neck portion **28**. Neck portion **28** is generally cylindrical in cross-section and tapers to a smaller diameter towards proximal **30** end. Neck portion **28** is defined along a second axis forming an obtuse angle of about **35** degrees with the longitudinal axis, allowing a surgeon to rotate head component **12** 180° about the

longitudinal axis for a medial or lateral inclination. Various obtuse angles are possible for modify the medial or lateral inclination to accommodate the needs of the particular patient. Proximal **30** end of neck portion **28** is configured with connection portion **14** for mating with taper connection portion **32**. Preferably, the connection portions are of the Morse taper type. Connection portion **14** includes retaining groove **34** adapted to receive spring washer **36** for producing a friction fit as the connection portion is inserted into taper connection portion **32** of ball **22**.

FIG. 3 shows end views of head portion **12** and quick-disconnect **26**.

Referring to **FIG. 1**, stem component **16**, having opposed proximal **38** and distal **40** ends, is located at the end of the trial defining a longitudinal axis. Stem **16** includes tip portion **18** and connection portion **20** longitudinally opposed from the tip portion. The tip portion is adapted to be received in the medullary canal of femur **42** as shown in **FIG. 6**. Various lengths of tip portion **18** are provided to correspond to the depth of the medullary canal of the femur. Connection portion **20** includes engagement groove **44** for releasably engaging quick-disconnect **26** of trial head **12**. Surrounding proximal **38** end is circumferential collar **46** for facilitating proper positioning of trial stem **16** in the medullary canal of femur **42**. Axial slot **48** is formed in collar **46** for mating with tab **50** on quick-disconnect **26** to prevent rotation of stem **16** with respect to head **12**.

With further reference to **FIG. 1** and **4**, an intermediate component, generally indicated at **52**, having a pair of interchangeable connection portions for mating engagement with another intermediate component and with head **12** and stem **16** components, respectively. Intermediate component **52** defining the longitudinal axis includes opposed proximal **54** and distal **56** ends. Proximal **54** end is configured with connection portion **58** including engagement groove **55** for engaging quick-disconnect **26** and distal **56** end configured with quick-disconnect **60** for engaging connection portion **20** or the connection portion of another intermediate component. Slot **62** is formed in the intermediate component for mating with tab **50** and tab **64** is provided for mating with slot **48**. The tabs and slots when engaged prevent the components from rotating with respect to each other. A surgeon can selectively alter the length and size of trial by using various lengths and sizes of heads, stems and intermediate components depending on the needs of the patient.

In **FIG. 4**, quick-disconnect **60** is shown with parts broken away and partially cross-sectioned. All of the quick-disconnects have the same structure and are interchangeable with one another. The quick-disconnect comprises slidable sleeve **66** encircling distal **56** end of intermediate component **52**, internal spring **68** or similar means for urging sleeve **66** into the locked position, pin **70** mounted perpendicularly to the longitudinal axis of the sleeve and balls **72, 74** and **76**. Pin **70** supports spring **68** and transfers the force of the spring to sleeve **66**, urging it to remain in the locked position. The orientation of spring **68**, pin **70** and balls **72, 74** and **76** is best viewed in **FIGS. 5** and **6**.

Referring to **FIG. 6**, the quick-disconnect for releasably engaging connection portions **20** and **58**, or intermediate portion **52**, as the case may be, is shown. As noted, engagement groove **44** encircles connection portion **20** near the end and is adapted to receive balls **72, 74** and **76** situated in sleeve **66**. The distal inner portion of sleeve **66** is provided with a portion of enlarged inner radius **78** that allows balls **72, 74** and **76** to move radially outward when sleeve **66** is raised into the position shown. When engagement groove **44** is aligned with the balls, sleeve **66** is lowered and the balls **72, 74** and **76** are forced into the engagement groove by the sleeve to couple the quick-disconnect to connection portion **20**. The quick-disconnect can easily be uncoupled from connection portion **20** by sliding sleeve **66** upward, thus allowing balls **72, 74** and **76** to move outwardly out of engagement groove **44**.

Other modifications of the trial of the present invention will become apparent to those skilled in the art from an examination of the above specification and drawings. Therefore, other variations of the present invention may be made which fall within the scope of the following claims even though such variations were not specifically discussed above.

Claims

1. A modular trial instrument having opposed ends for sizing of an implantable orthopedic prosthesis, the trial comprising in combination:

   a head component located at one end of the trial and having at least one connection portion;

   a stem component located at the other end of the trial and defining a longitudinal axis, the stem including a tip portion and a connection portion longitudinally opposed from the tip portion, the tip portion adapted to be received in the medullary canal of a bone.

2. The modular trial instrument of claim 1 further comprising at least one intermediate component having a pair of interchangeable connection portions for mating engagement with another intermediate component and with the head and the stem components, respectively.

3. The modular trial instrument of claim 1 further comprising a releasable interlock mechanism for

rapidly coupling and uncoupling the engaged connection portions of the trial components to reflect the proper size of prosthesis for a patient.

4. A modular trial instrument having opposed ends for sizing of an implantable orthopedic prosthesis, the trial comprising in combination:

a head component located at one end of the trial and having at least one connection portion;

a stem component located at the other end of the trial and defining a longitudinal axis, the stem including a tip portion and a connection portion longitudinally opposed from the tip portion, the tip portion adapted to be received in the medullary canal of a bone;

a releasable interlock mechanism for rapidly coupling and uncoupling the engaged connection portions of the trial components to reflect the proper size of prosthesis for a patient.

5. The modular trial instrument of claim 4 further comprising at least one intermediate component having a pair of interchangeable connection portions for mating engagement with another intermediate component and with the head and the stem components, respectively.

6. The modular trial instrument of claim 4 wherein the head component includes a neck portion extending outwardly from the head component, the neck portion having a connection portion.

7. The modular trial instrument of claim 6 wherein the neck portion is defined along a second axis forming an obtuse angle with the longitudinal axis, the connection portion of the neck head adapter for engagement with a ball component.

8. A modular trial instrument having opposed ends for sizing of an implantable orthopedic femoral prosthesis, the trial comprising in combination:

a ball component;

a head component including a neck portion extending outwardly from the head component, the head located at one end of the trial, the neck component having a connection portion adapted for engaging the ball component;

a stem component located at the other end of the trial and defining a longitudinal axis, the stem including a tip portion and a connection portion longitudinally opposed from the tip portion, the tip portion adapted to be received in the medullary canal of a femur;

a releasable interlock mechanism for rapidly coupling and uncoupling the engaged connection portions of the trial components to reflect the proper size of prosthesis for a patient.

FIG. 1

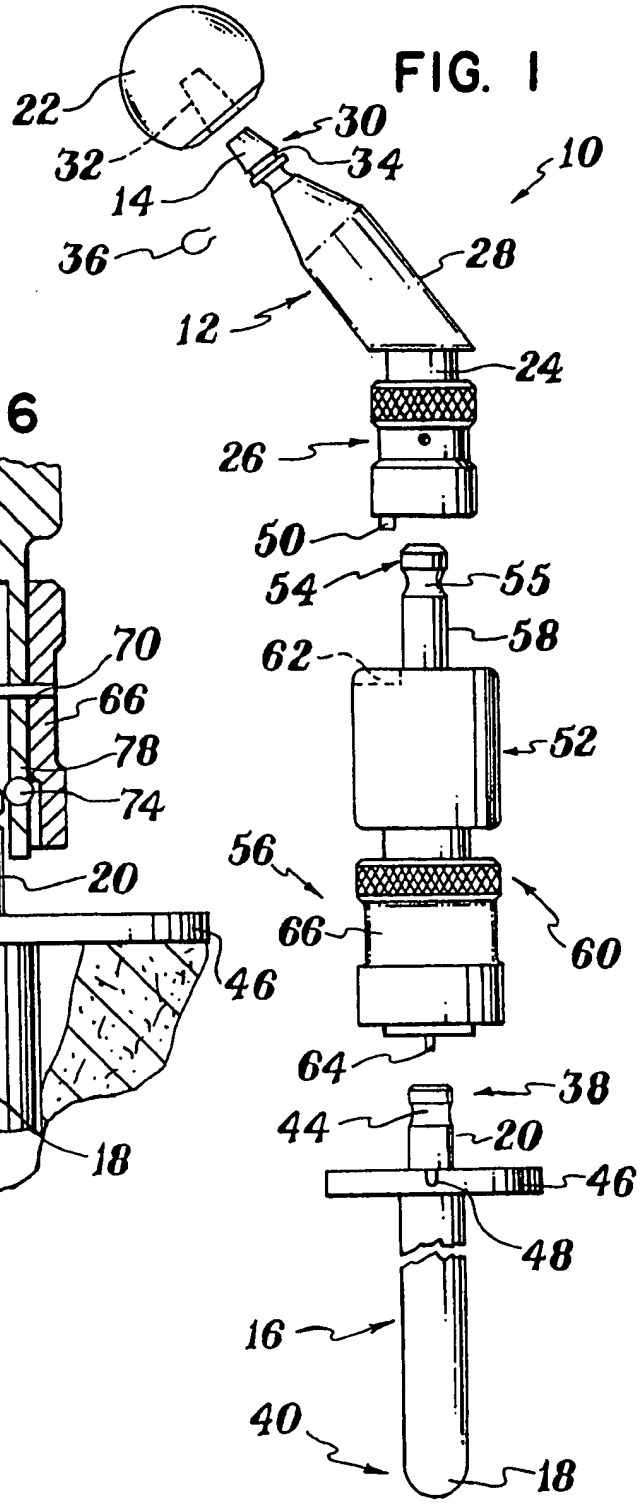
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FIG. 6

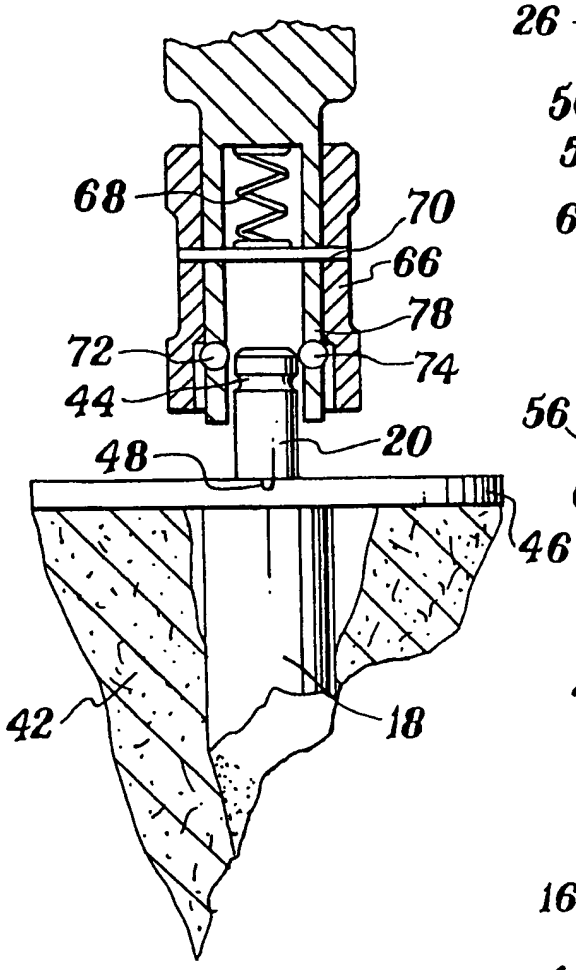
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FIG. 2

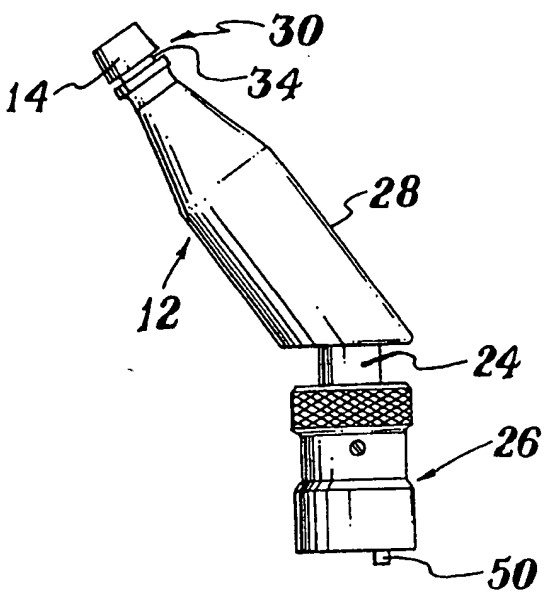

FIG. 3

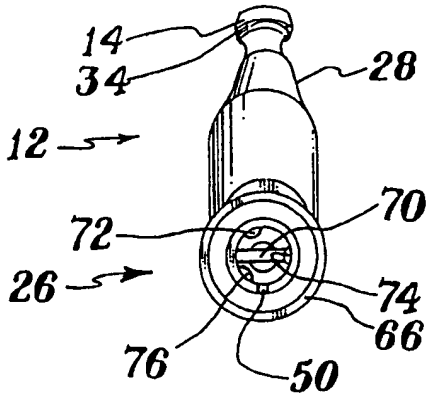

FIG. 4

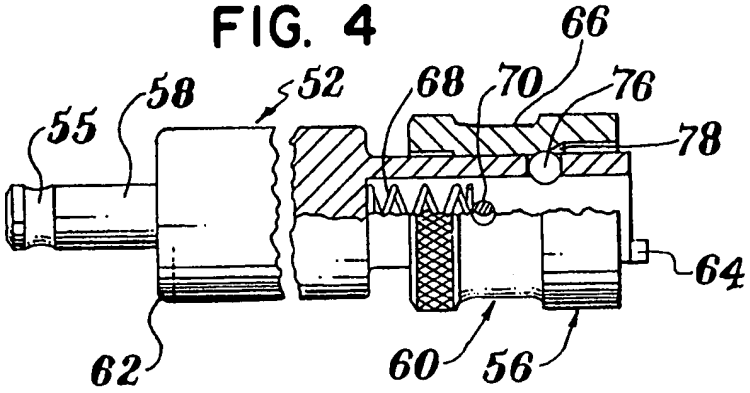

FIG. 5